## History of the Space Shuttle Volume 2

## Development of the Shuttle, 1972–1981

T.A. HEPPENHEIMER

**SMITHSONIAN INSTITUTION PRESS** 

۰.

WASHINGTON AND LONDON

## Contents

List of Illustrations
List of Tables
Acknowledgments
Prologue
6
Abbreviations and Acronymsxxiii
•
Chapter 1. Launching the Program1
NASA Fights for Its Budget2
Congress and the General Accounting Office
Trimming the Weight, Farming Out the Work
Managing the Program
Chapter 2. The Expanding World of the Shuttle
Europe's Background in Space
Europe and the Shuttle
Spacelab, Ariane, and ESA
The External Tank
The Solid Rocket Boosters
The Air Force and the Shuttle
Chapter 3. Odyssey of the Enterprise
The Shuttle Orbiter as a Glider
Choosing the Carrier Aircraft
Construction, Roll-Out, Prelude to Flight
First Flights
The Shuttle Takes Wing
The Odyssey Continues
j.
Chapter 4. Propulsion I: The Space Shuttle Main Engine
Starting the Project
Starting the Engine
The Fuel Turbopump
The Oxygen Turbopump and Fuel Turbine Blades
The Need for Testing
Preludes to Flight

## Contents

Chapter 5. Propulsion II: SRB, ET, OMS, RCS, APU173The Solid Rocket Booster173Development and Test: The View from Thiokol183The External Tank190Storable Propellants and On-Orbit Maneuvering198Auxiliary Power Units203
Chapter 6. Thermal Protection209Early Developments209Protecting the Shuttle216Test and Development224The Shuttle Comes Unglued232
Chapter 7. The Orbiting Airplane245Aerodynamics and Structures245Fuel Cells for Power255Environmental Control and Life Support260Auxiliaries: Landing Gear, Remote Manipulator, Space Suits269Safety and the Shuttle278
Chapter 8. The Electronic Shuttle287Defining the Requirements287The On-Board Computers289Software297Avionics306The Launch Processing System313
Chapter 9. The Program Struggles323Schedule, Performance, and Cost323Shuttle Upper Stages330Budget and Management337Carter and the Shuttle346The Space Telescope357A Tale of Two Cities362

ŗ

Chapter 10. Preparation for Flight	
Kennedy Space Center	
Defining the Missions	
Astronauts for the Shuttle	
Into the Countdown	
Coda: The Working Shuttle	
Notes	
Bibliography	
Books, Reports, and Papers	
Books, Reports, and Papers, by Source	451
Periodical Literature, by Date	
Index	471